Yogurt based food: 'Soy yogurt drink with kiwi Flavour'

Unit Ⅳ: Product commercialisation

Group B

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Executive Summary

The goal of this unit was to complete the entire product testing before the product launch, and develop the product commercialisation report. Product optimisation was conducted but did not finish completely in Unit III, therefore the optimisation of the product was continued at the beginning of this Unit. A commercial product test was conducted after the optimisation to ensure that the final product meet the consumer expectations. In addition, shelf life and all the factors affecting it were investigated in combination with packaging proposal for quality and safety requirements. Both UK and EU food labelling legislation were addressed to make sure the package and label of the final product is safe and legal for launch. Good manufacturing Practice (GMP), Good Hygiene Practice (GHP), Hazard Analysis Critical Control Points (HACCP) analysis and quality control plan were conducted in this unit to ensure the quality and safety of the final product.

By analyzing the optimization results, two most acceptable samples with almost the same rating were chosen to do the commercial testing, which were i) sample with 11% cow's yoghurt and 12% kiwi, ii)sample with 18% cow's yoghurt and 8% kiwi. The sugar and water percent for both of the 2 samples were constant at 10.5% and 20%. These two products with two other competitors' product in the market were evaluated by 56 untrained assessors. The results indicated that both of our two products are more acceptable by assessors, and within 4 products, the one with 11% cow's yoghurt and 12% kiwi juice got highest mark which was chosen as the final product to do the shelf-life experiment.

Shelf-life is "the period during which a food product maintains its microbiological safety and suitability at a specified storage temperature and, where appropriate, specified storage and handling conditions" (FSA 2010). There are various factors that affect the food shelf life, and the most important factors for the yoghurt drink are the microorganisms, pH, temperature, water activity, oxygen and the humidity. The shelf-life of the drinking yogurt product can be determined by sensory evaluation and pH measurement which was carried with trained assessors in the lab . Packaging plays a crucial role not only in marketing and carrying important information on the label relating to preparation, safety and nutrition, but also in shelf life of yoghurt drink in order to maintain its quality. To achieve the desired shelf life of the yogurt drink (2-3weeks) and maintain its quality primary, secondary and tertiary packaging are recommended in this unit. It was decided that the primary package of the yoghurt drink will be PET bottles with aluminium seal to make packaging more effective, and Paperboard laminated cartons are used as secondary packaging, while the tertiary packaging will be Pallets or crates.

According to the legislation of labelling, product information on the label will include the name of the product, list of ingredients, name of manufacturer, manufacturing date, used by, allergens(soy and kiwi), Flavour(kiwi), net quantity expressed in ml, name of distributor, definition of yogurt drink and conditions of storage (Temperature= 4°C).

The prerequisite as Good Manufacturing Practice (GMP) and Good Hygiene Practice (GHP) have to be proposed before implementing the Hazard Analysis Critical Control Points (HACCP) plan. Since the HACCP analysis also link to GMP and GHP, the information of GMP and GHP has to be specific for the process and layout of yoghurt drink product. Then HACCP analysis of production process was conducted in this unit. All the potential biological, chemical, and physical hazards that may be introduced, increased, or controlled in the production process were evaluated. Pathogens (*E.coli*, *Cryptosporidium parvum*, *staphylococcus aureus*, and *Salmonella*), patulin, pesticides and metal fragments were considered to be the main potential hazards in yoghurt drink.

Quality control is used to control the quality of the products, process and service support to ensure the processed food meets the specific quality requirements. Therefore, the quality control plan was conducted and the most important task for this plan was to develop a comprehensive approach to monitor the quality and safety of the yoghurt drink. The raw material control, process control and finished product inspection was conducted to make sure all the parameters are under control, and do the correction if there are any unacceptable level of hazards in the final product.

1. Unfinished tasks from Unit III

The optimisation results showed that the 3D plots for different attributes and overall acceptability are not in the exactly same way. By checking the response of all the 54 assessors, some assessors give quite low or quite high marks for all samples, and some assessors give same marks for all or most of the 9 samples which shows that they can not test the difference of the 9 samples or they did not understand how to rate with 9 point hedonic scale.

Table 1. The 9-point hedonic scale

1	2	3	4	5	6	7	8	9
Dislike extremely	Dislike very much	Dislike medium	Dislike slightly	Not like or dislike	Like slightly	Like medium	Like very much	Like extremely

Base on the results of optimisation, at first 18 assessors whose results seem not to show the correct response were chosen from the 54 assessors to test 9 samples (the same with optimisation samples) in two separate days. There were 5 samples on the first day, and another 5 samples were on the second day. Out of the 5 samples of second day 1 sample was from the 5 samples of day one, with optimised sugar percent (10%). This sample was the best one among the 5 samples of first day. While conducting this test, the assessors were asked to mark each sample with 9 point hedonic scale without comparing the one sample with another. Assessors were instructed to wait for a minute after testing the one sample. And the assessors were asked to write the opinions about each sample and the best one was chosen among the 9 samples.

The statistical analysis of the results was accomplished using the R project in the same way of optimisation experiment. By comparing the mean value and rating given by 18 assessors, it was found that they did not have depth understanding of the 9 point hedonic scale. And rating given by them did not help to optimise the product. Nevertheless, it was observed that the average scores of the samples were higher probably due to improvement in the test environment and test method. So it was decided to discard those 18 assessors from 54, and use the data of 36 assessors only. The following 3D plots explain the response of 36 assessors.

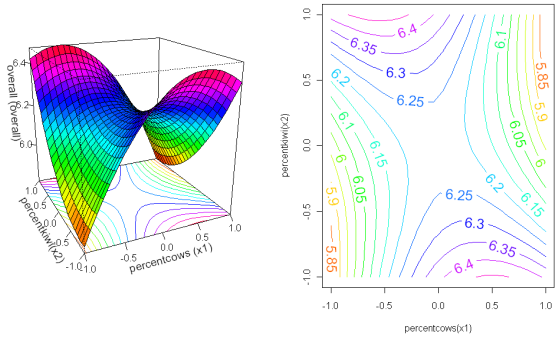


Figure 1. Response surface plot for overall acceptability

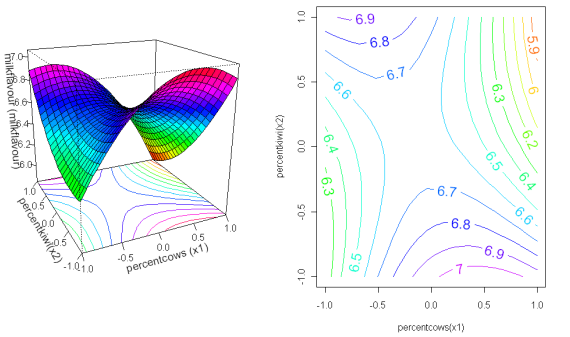


Figure 2. Response surface plot for milk flavour

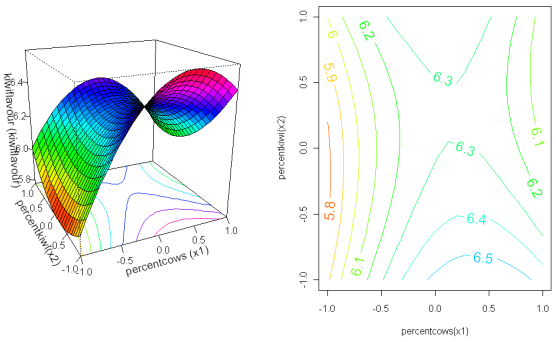


Figure 3. Response surface plot for kiwi flavour

The results showed that all the attributes and overall acceptability go to the same direction, and the results showed that assessors prefer low kiwi percent and high cow's yoghurt percent, and on the other hand, the sample with high kiwi percent and low cow's yoghurt percent got higher mark as well, since the highest mark of these two direction are same by combine all the results from optimisation and this test, 2 samples were chosen to do the commercial

test, which are samples with 11% cow's yoghurt and 12% kiwi, and 18% cow's yoghurt and 8% kiwi. The sugar and water percent for both of the 2 samples were constant at 10.5% and 20%. In this case, the results of commercial test can also give the response on optimisation.

2. Conduct a commercial product test using a test market

Commercial test is the final stage of product testing. In this stage, test products and market products were chosen to conform if the final product meets up to the expectation of the consumers. In other words, the original WHATs, sweetness, milk flavor, kiwi flavor and thickness, have to be achieved and the overall acceptability of the product should be determined, which all should be confirmed in commercial sensory test.

According to the results in Unit III and unfinished tasks form Unit III, there are two directions showing the best two formulations. The amounts of ingredients of 2 combinations of 'Low fat soya yogurt drink with kiwi flavor' were listed below in **Table 2**. The differences between those two products are that the ratio of cow's yoghurt and soya yoghurt and kiwi juice percentage were different. For percentage of sugar and water amounts were constant. Ingredients, cow's yogurt, soya yoghurt and kiwifruit, were bought directly from the supermarket. The cow's yogurt was 'Morrissons' brand, 1.5 % fat. The soya yoghurt was 'Alpro Soya Plain Yogurt', fat content 4%. Additionally, another two market products were 'low fat drinking yoghurt with L.casei Danone culture, Vitamin B6+D and multifruit' and 'low fat drinking yoghurt with L.casei Danone culture, Vitamin B6+D and orange' of 'Actimel' brand. The reason for chosen those two market products is that those two yoghurt drink contain acidy fruits and low fat, which have similar formulations with 'Low fat soya yogurt drink with kiwi flavor'.

Table 2. The 2 best combinations.

Ingredient	Cow's yoghurt (%)	Soya yoghurt (%)	Kiwi juice (%)	Sugar (%)	Water (%)
A1	11	46.5	12	10.5	20
A2	18	43.5	8	10.5	20

Furthermore, four product samples were evaluated for four attributes and overall acceptability by 56 untrained assessors. A balanced complete block was used. A preference test with 9-point hedonic scale commercial sensory test was conducted and finished by using 'Compusense Five' in sensory taste panel room in one day. Four products were labeled on different codes during the commercial sensory test. Before each sensory test, assessors would be required to sign in the allergy form to make assessors understanding sensory test. The meaning of the 9-point hedonic scale would be explained to assessors. Samples would be presented one by one. Twenty seconds time would be controlled between two samples and 'drink more water between 2 samples' would be suggested. As temperature is an important parameter for sensory test, 4-6°C of samples' temperature would be insured during the experiments.

The results of the commercial test would be analysed by using the project R. As a preference test with 9-point hedonic scale was taken in the experiment, the single factor within-subject ANOVA with rating test would be used first, which includes Tukey additivity test and ANOVA test. If the Tukey additivity test is not rejected and the ANOVA test is significant, then the Tukey's honestly significant difference test would be conducted. Otherwise, if the Tukey additives test is significant, which means that there was interaction between two samples, so that the Friedman test would be used. What is more, if the results show the Friedman test is rejected, Tukey HSD by ranks test would be acted. The analysis was divided into 5 parts which expressed attributes individually. For results of sweetness, milk flavour, thickness and overall acceptability, the Tukey additivity tests were not rejected and the ANOVA tests were significant. In consequence of Tukey's honestly significant difference test were carried on (Table 1, Appendix.In the results of Tukey's honestly significant difference test, take sweetness as an example, the difference of sample A and sample B is -0.08928571 indicated that the value of sample A is bigger than B, which means that sample A is more acceptable than sample B. From the test, it suggested that sample A (Low fat soya yogurt drink with kiwi flavour 1, code no.949) is the most acceptable one among 4 samples except milk flavour. Sample B contain more cow's yoghurt than that in sample A, so that the milk flavour is more acceptable. However the overall acceptability suggested that sample A is better than B, much better than C and D. To sum up, the trends of acceptability should be A>B>C>D.

For fruit flavour, the Tukey additives test is significant and the Friedman test is rejected, the Tukey HSD by ranks test

was acted. The result of Tukey HSD by ranking test was shown in table 5. Any rank difference greater than the critical HSDRank (35.1588) is significant. For example, there is no big difference between samples A and sample B as the rank totals is 4.0000. However, the rank totals of sample A and Sample C is 140.0000, which is significant; moreover, compared with the sum value of sample A and C, the sum value of sample A is bigger than C, and consequently, sample A is more acceptable than C. As a result, sample A is much better than the other samples.
In conclusion, the results of the commercial sensory experiments illustrate that sample A is the best formulation among four samples. The combination of sample A would be used in next stage of shelf –life test.

3. Determine intrinsic and extrinsic factors affecting shelf-life and propose methods to control and monitor shelf-life

In accordance with The Codex Alimentarius, shelf-life can be defined as "the period during which a food product maintains its microbiological safety and suitability at a specified storage temperature and, where appropriate, specified storage and handling conditions" (FSA 2010). On the other hand, in conforming with the Institute of Food Science and Technology (IFST) in the United Kingdom, shelf life can be delineated as "the period of time during which the food product will remain safe; be certain to retain desired sensory, chemical, physical, microbiological and functional characteristics; and comply with any label declaration of nutritional data when stored under the recommended conditions" (Anon., 1993). In other words, shelf life can be described as the time where all the principal properties of the food remain acceptable for consumption. Consequently, shelf life states the time for which a food can remain on the retailer's and then the consumer's shelf before becoming unacceptable. Currently, a definition for shelf life was set for first time in EU legislation, in Commission Regulation (EC) No. 2073/2005 according which "shelf life means either the period corresponding to the period preceding the 'use by' or the minimum durability date, as defined respectively in Articles 9 and 10 of Directive 2000/13/EC"(Robertson 2010).
A large amount of factors can affect the shelf-life involving: the Good Manufacturing Practices (GMP), the Good Hygiene Practices (GHP), the effective application of Hazard Analysis and Critical Control Points (HACCP)-based procedures, the quality of raw materials, the processing steps, packaging (including gas atmosphere), the conditions of distribution, the storage temperature, the product formulation, e.g. pH, water activity (aw), the use of preservatives and finally the intended use. These factors can control the microbiological growth and changes in chemical, physical and sensory qualities that lead to the product becoming unsafe (FSA 2010).
The key of predicting the shelf-life is the knowledge over the types of deteriorative reactions that impact food quality. These reactions are influenced mainly by two factors: the nature of the food (its properties, formulation and processing parameters) and its surroundings (environment to which expose during distribution and storage) which compromise the intrinsic and extrinsic parameters respectively. Package properties can also account as a controlling factor of shelf life since its properties can influence numerous of the extrinsic factors and consequently affect the rates of the deteriorative reactions (Robertson 2010).
The intrinsic factors involve water activity (a_w), pH, oxidation-reduction potential, O_2 content enzymes, microorganisms and concentration of the reactive compounds. The majority of these factors can be controlled by the appropriate selection of raw materials, ingredients and processing parameters. Firstly, in respect to water activity, it can be described as the ratio of the water vapour pressure of a food to the vapour pressure of pure water at the same temperature (Robertson 2010). All microorganisms require water for growth thus each one has a maximum, optimum, and minimum aw for growth and survival. At the minimum aw, growth is usually minimal, increasing as the a_w increases. In addition, even if the a_w is below the minimum for growth, bacteria do not necessary die (Nilsson et al. 2006). Furthermore, water activity is a quite useful parameter in predicting the growth of bacteria, yeasts and moulds (principal agents of microbial spoilage of yogurt). More specifically, the microbial cell must compete with solute molecules for free water molecules – molds and *Staphylococcus aureus* are excellent competitors. (Nilsson et al. 2006). *Clostridium botulinum*, the most dangerous food poisoning bacterium (present in our product as well), is unable to grow at an a_w of 0.93 and below while most of the moulds stop growing at a_w of 0.8 and below (Nilsson et al. 2006). Furthermore, milk contains 91% moisture and has a water activity equal to 0.95. On the other hand, yogurt's moisture is about 89% (Nilsson et al. 2006). Even if the exact moisture content of our

product is not known, it is appreciate to be around 93% which means that as high water activity. As a consequence, it can be considered as a highly perishable product, having very short shelf life (~15-20 days).

As for the pH, the majority of microorganisms have roughly a neutral pH optimum (pH 6-7.5). In addition, yeasts compared to bacteria, can grow in a more acid environment while moulds normally grow in a large pH range preferring slightly acid conditions. Furthermore, yeasts and moulds, in the presence of sucrose and lactose (milk sugars) which can be used as energy sources, spoilage is facilitated (Robinson and Tamine, 1981). As milk has a pH of 6.6, it is becoming ideal for the growth of many microorganisms. The preliminary measurements of our product indicated that the pH is approximately to 4,1. The final results according to pH should be presented on Unit V.

Regarding the oxidation – reduction potential, compromise the regulating parameter of oxidizing or reducing properties of the medium, depending on the composition of the food, pH, temperature and on the concentration of dissolved O_2. This factor has a fundamental role on microorganisms' growth ability, enzyme expression and thermal resistance. The implementation of oxidation – reduction potential and dissolved O_2 in milk is not well established. Reduction of oxidation – reduction potential in milk can improve its quality. What is more, as vitamins are susceptible to oxidation, dissolved O_2 can significantly reduce the content of vitamins C, B_6, B_{12} and folic acid (Robertson 2010). Concerning the extrinsic factors, these include temperature, Relative Humidity (RH), light, total and partial pressures of different gases and mechanical stresses, including consumer handling. Several of these factors, have an impact on the rates of deteriorative reactions that occur during the shelf-life of a product (Robertson 2010). At first, temperature is a crucial factor on determining the rate of deteriorative reactions. In addition, the material of packaging can have effect on the temperature of the yogurt drink as well. The products (like our product) that should store and pack in refrigerated cabins, the cooling occur mainly by conduction and convection. Therefore, there is some heat contribution from the fluorescent lamps used for lighting. For this reason, the package should be designed in such a way to provide high reflectivity and high conductivity (Robertson 2010). Moreover, as sterilisation is part of our product process, heating must be kept at the level (40˚C) where a quite small amount of heat-resistant spores will survive. In this way, unpleasant chemical or organoleptic changes (taste, odour, colour, feel) will be avoided. What is more, on the conduction of shelf life experiments, the conditions where the product is going to be selled have to simulated. Therefore, for our product, the recommended storage temperature of 4°C was used on the shelf-life testing as well. Furthermore, the growth rate of bacteria during storage at low temperatures gives a better indication of the shelf life. A good way for testing the post-pasteurisation contamination could be by Moseley count (the plate count after 5 days of storage at 7 °C – the plate counts after processing). Also, the optimum temperature for lipase and protease activity is normally lower than the optimum for bacterial growth. Consequently, off-flavours can develop even if the bacterial counts are low. For testing the off-flavour in shelf life experiments, flavour evaluation after storing at 7°C can be a useful way (Robinson and Tamine, 1981). In high temperature (e.g room temperature), it was observed that the yogurt drink develop an unpleasant texture and odour, syneresis is occurred (separation of whey or serum), small particles are formed, smoothness is reduced - as a result of the growth of microorganisms (Robinson and Tamine, 1981).

Additionally, relative humidity (RH) of the ambient environment can have an impact on the water activity. This certainly depends on the package which has to block water vapour. In accordance to our product, PET bottles as packaging material has selected which can provide water vapour block. Furthermore, the presence of gases in the environment surroundings of yogurt drink can have an effect on the atmosphere inside the package and also, it can affect the microorganisms' growth. Therefore, the removal of air prior to sealing is required (Robertson 2010). This can be achieved by vacuum packaging, something that had been considered to the packaging of our product as well.

Numerous deteriorative alterations can be occurs in the nutritional quality of the yogurt drink because of the light. Discoloration and flavour defects are the two main indices of failure which largely depended on the intensity of light and the length of exposure. These can be avoided by the incorporation of dyes or application of coatings on the PET bottles (Robertson 2010). Therefore, on the design of the shelf life experiment (it would be discussed further), lighting was taken into account as well.

Last but not least, microorganisms can induce to both desirable and undesirable changes to the quality of yogurt drink. The desirable changes arise from the inoculation and fermentation process while the undesirable ones

comprise the yogurt drink spoilage. Yeasts and moulds are the major causes of microbial spoilage of yogurt drink. In fresh yogurt products, yeasts and molds may be present because of contamination in the processing, induding fruit juice extaction, packaging material (PET bottles), or filling operations. Since the yogurt drink is a pasteurized product, microbial spoilage due to yeast and moulds is not such concerning, when packaging and processing operations are well controlled. Drinking yogurt heated to 62.5°C may contain only few cfu Ml^{-1}, where the counting possibly involves spore-forming bacteria, which do not well grow in acidic environment. Therefore, the impact on the yogurt drink's shelf life is insignificant (Nilsson et al. 2006).

The shelf-life of the drinking yogurt products can be determined by visual assessment, sensory profiling or analytical measurements. Firstly, stability of the product can be assessed by the exposure of the product to mechanical stress during the manufacturing of the product (e.g increased storage temperature). This could result to the breakdown of stabile protein, leading to sedimentation of the protein. The use of stabilisers, such as high methoxy pectin (on industrial scale) can be used for the prevention of sedimentation. In addition, the stability of yogurt drink is closely related to the level of stearic stability. Since kiwi pulp is added, the presence of large particles may be due to protein aggregation and may leads to instability. The particle size of the yogurt drink can be measured by the Malvern Mastersizer (Nilsson et al. 2006). Furthermore, stability of the product can be confirmed by viscosity measurements. Also, viscosity measurement can be used for determine the optimal pectin concentration i.e when the viscosity increases during storage and the sedimentation percentage is very low. Finally, the sensory profiling of yogurt drink by a trained sensory panel could be quite useful on demonstrating the consumer's perception (Nilsson et al. 2006).

Taking all previously mentioned into account, a shelf life experiment was designed. In this experiment, it was decided to compare our product's shelf life with a commercial product ('Actimel'orange drinking yogurt). Due to technical difficulties, it was decided that the examined parameters should be only the pH in combination with some sensory testing where the odour is going to be assessed. The experiment was planned to have a duration of 4 weeks, but the normally shelf life of a drinking yogurt is between 2-3 weeks. Measurements and sensory evaluation are going to take place every 2 days, including the zero day. Therefore, 12 sterilised glass bottles were filled with our product and 12 with the commercial one. Glass bottles were selected for technical reasons and they were covered with aluminium foil in order to be protected by the light. In addition, 14 trained assessors assess the two products in terms of their odour and they are being asked to declare whether the product is acceptable for consumption. The results and further analysis will be presented on Unit V since the experiment it still under conduction.

4. Propose adequate packaging that meet food quality and safety requirements

Packaging is the science, art, and technology of enclosing or protecting products for distribution, storage, sale, and use. It can be described as a coordinated system of preparing goods for transport, warehousing, logistics, sale, and end use. Labelling is any written, electronic, graphic communications on packaging or on separate but associate. Packaging mainly gives protection from any mechanical shock, vibration, electrostatic discharge, compression, temperature change. It prevents the product to come in contact with metals, glass, dust, dirt, insects etc. (Robertson 2010). Packaging also helps to protect the form, shape and texture of the food inside, preventing the loss of flavours and odours and will often extend the products shelf life. Packaging also assists in regulating the water or moisture content of the food to keep it as fresh as possible. The choice of packaging material should not affect the nutritional quality of a product .Best packaging material is barrier from water vapour, oxygen is often required in order to extend the shelf life.). Most important package gives security to food product by ensuring safety by complying with legislation. (World Packaging Organisation 2009).Packaging carries important information on the label relating to preparation, safety and nutrition, providing evidence that the package is intact and the product has not been tampered with, identifying the date and the location of manufacture for inventory control and identification of potential hazards.

Packaging plays a crucial role in shelf life of yoghurt drink in order to maintain its quality. Various extrinsic and intrinsic factors such as temperature, oxygen, microbial content, light, pH, water activity, consumer handling affects the shelf life of yoghurt drink. Proper selection of packaging material could aid to inhibit the effect of all these factors on shelf life. Furthermore, it can be seen from effects of all these factors(explained in task 3), the most

important requirement of shelf life of product is to have appropriate packaging which will protect yogurt drink from the adverse effects of all the above factors. Moreover, it affects on safety of the consumer. Factors affecting the environmental impact of packaging must also be taken into consideration. To achieve the desired shelf life of the yogurt drink (2-3weeks) and maintain its quality, primary, secondary and tertiary packagings are recommended which are specified for our product as follows:

Primary packaging is that which is in intimate and direct contact with the contents. As such it represents the major barrier between the product and the environment. Mainly PET is recommended as best primary packaging materials for the yogurt drink with consideration of all extrinsic and intrinsic factors. PET is modestly good oxygen, water vapour barrier and tough. PET has property to stay intact throughout cycle of distribution. PET bottles would be sealed with aluminium foil to make packaging more effective. It would be opaque to avoid the effect light on product. It is temperature resistant, prevents the entry of any flavour, odour into product from environment. Furthermore, as its good barrier to oxygen, prevents oxidation of the product. Secondary packaging is usually an outer carton or multipack that enables the consumer to carry more than one primary package of a product at a time. Paperboard laminated cartons are used as secondary packaging. Shrink sleeves could be used for labelling and decoration. (Roger D Macbean). Paperboard cartons would protect from light and would carry label which explains details of the product which are explained further. Tertiary packaging unitizing many primary and/or secondary packages to facilitate the movement of a large multiple of packages as a single entity (Chandan 2006). Pallets or crates, both materials can be used as tertiary packaging which gives minimum damage to the product and easy carrying.

Packaging materials chosen for our product comply with existing regulation such as the Materials and Articles in Contact with Food Regulation, Packaging and Food safety consideration, especially for plastics includes the name under which the product is sold, a list of ingredients and quantities, potential allergens (soy and kiwi), used by date and conditions for storage, nutritional information, manufacturers name, manufacturing date etc.

Good graphic design could be performed to insure that the package of our product appearance in retail display has visual impact in mass among an array of other competitive packages which could be made with picture of yogurt drink and kiwi (Chandan 2006). Labelling is another most important aspect of packaging. The details that would appear on packaged soy yogurt drink with kiwi flavour are as follows-

- Name of manufacturer, manufacturing date, used by, ingredients(including stabiliser, acidity regulator), allergens(soy and kiwi), Flavour(kiwi), net quantity expressed in ml, name of distributor, definition of yogurt drink, conditions of storage
- Package of drink intended for retail sale must declare quantitative nutritional information expressed in terms of a "serving" of an individual food.
- Barcode which would help for the traceability

The following label format explains how the label of our product would appear on package (It is example, not label of our product):

Nutrition Facts

Serving Size 1 Container (8 oz.)

Amount Per Serving	
Calories 127	Calories from Fat 4
	% Daily Value*
Total Fat <1g	0%
Saturated Fat 0g	0%
Cholesterol 5mg	2%
Sodium 175mg	8%
Total Carb 17g	6%
Dietary Fiber 0g	0%
Sugars 17g	
Protein 13g	
Vitamin A 0%	Vitamin C 4%
Calcium 45%	Iron 2%

*Percent Daily Values (DV) are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Bottle is most recommended, suitable the option, would be used for filling the yogurt drink which is easy to drink and carry. From the market survey and requirements of consumer, it is preferable option to make PET bottles of 250ml. Four bottles of 250ml would be placed in one carton followed by pallet or crate.

It can be concluded that packaging material recommended for our product meets with all requirements of shelf life and would maintain quality of our product. Moreover, it complies with legislation of labelling and packaging. Furthermore, all packaging material which would be used for product is environment friendly and cost effective.

5. Demonstrate that the product and its production process is in compliance with national and EU labelling legislation and food safety requirements

Drinking yogurt is categorised as stirred yogurt of low viscosity (Tamine 1999). The Food Labelling Regulations set by EU in 1996 is the basic labelling regulation of United Kingdom. The regulation is revised and issued yearly. The Food Safety Act 1990, Trade Descriptions Act 1968 and Weights and Measures Act 1985 should also be obeyed for the labelling. The FAO and WHO developed Codex Alimentarius Commission to guide the international standards for the labelling and production. The Code of Practice for The Composition and Labelling of Yogurt by Dairy UK gave us some information for labelling. Labeling of bottles and packages containing milk products, such as yogurt, should follow the general requirements by The Food Labelling Regulation 1996. These are listed below:

The name of the food, a list of ingredients, the appropriate durability indication, any special storage conditions or conditions of use , business name and address. Besides, more special information should be listed such as place of origin and instructions for use (SI 1996).

1. Name

Some food is prescribed by law and must be listed as the legal name. Yogurt is not a name prescribed by law so we can give it a descriptive name as the regulation mentioned. The form of the name could be more than one word. Drinking yogurt is categorised as stirred yogurt of low viscosity and a refreshing drink. So the drinking soy yogurt with kiwi flavor is available.

2. Ingredients

The ingredients are required to be listed in the descending order of the weight of them. The word "ingredients" must appear on the ingredient list as a head. The name we used to describe an ingredient is that it can be used when it is sold by itself for not leading to misunderstand, such as skim milk. Because the soy milk contains non milk fat we should list it separately. We can use generic terms (sugar) to instead more specific names for the purposes of listing ingredients of foods only. Kiwi and water are used as ingredients rather than juice in the product and the water exceed 5% so they should be listed separately instead of juice with special emphasis. Therefore, the ingredients of our product should be soy milk, cow's milk, water, kiwi, sugar, Stabiliser (pectin), Yogurt Cultures.

3. Nutrition labelling

When the nutrition claim is offered nutrition labelling is compulsory and must be given in a specified format, such as low fat yogurt. At least, the amount of energy (expressed as kJ and kcal), protein, carbohydrate and fat (all expressed in grams) are needed to be provided by 100g or 100ml of the food .there are also some voluntary ingredients which may not be given the details. For example, fibre, sodium and vitamin.

4. The appropriate durability indication

Use by is the required form of date mark only for yogurt as it is highly perishable from a microbiological point of view with a relatively short period. Once the date is over, it may cause poisoning. The words use by and the date in the form of the day and the month should be appeared on the mark.

5. Other general information

The name or business name and an address of the manufacturer or the seller are required to be labelled. The place of origin of the food and some instructions are needed even the yogurt is not difficult to make appropriate use.

6. Food Warning Statements

Products containing soy and milk should be declared as they may cause allergy action (FSA 2011).

7. Presentation

The label must be easy to read and understandable, visible for the consumers. There is no limit for the font but in order to make the pack clear, a font size of 10 point for the essential information is preferred .the minimum for this information should be 8 point for visible .if the label has few space, we can try to reducing space used for branding and claims or increase the label size without obscuring sight of the product where this is important to consumers (FSA 2008).

The name of the product, date mark and estimated net weight must be in the same field of vision

8. Batch identifier

In order to trace the different batch of the products, we should label batch identifier, such as Lot Mark or Batch Code.

6. Hazard Analysis Critical Control Points (HACCP) analysis of production process

Table 3.The description form of final product with ingredients and raw materials

Description of Final Product
Soy yogurt drink with kiwi flavour Soy yogurt drink with kiwi flavour will be packed in PET bottles of 250 ml and will be sold in a chilled product case to dairy store. This product is intended for everyday family drink. This product is made from selected soy and cow's milk from animals reared in selected group of farms under a team of milk experts. In addition, kiwis are supplied from selected farmers, growing under the best conditions. Soy and cow's yogurt are mixed together with fresh kiwi juice, keeping the seeds of the fruit. Finished product is to be kept chilled at 4°C during storage, transportation and display in retail store. The product has a best-used-by refrigerated shelf-life of 2 weeks from the date of manufacturing.
Intended use of Final Product
The product is intended for consumption by the general population except from people allergic to soy and kiwi. The refrigerated product must be kept at 4°C during storage. After opening must be consumed within 2 days.
Raw Materials and Ingredients List and Information

Name of Raw Material or Ingredient (Also Packaging)	**Spec. Number**	**Form Powder, Diced, etc.**	**Preservation Method: Dry, Refrigerated, Frozen, etc.**	**Packaging Bags, Drums Bulk, etc.**	**Size Package or Lots/ 10,000 Units (250ml/unit)**	**Other Information**
Cow's milk	01	Liquid	Cool (4°C)	Tanks	275L	Selective cows
Soy milk	02	Liquid	Cool (4°C)	Tanks	1162.5L	Selective suppliers
Kiwis	03	Whole	Cool and dry	Bags	500Kg	Trucked
Water	04	Crumbs	Cool and Dry	Plant Water System	500L	Source: City
Sugar	05	Granular	Cool and Dry	Air tight Bags	262.5Kg	Trucked
Stabiliser	06	Powdered	Cool and Dry	Air tight Bags		Trucked
Acidity regulator	07	Powdered	Cool and Dry	Air tight Bags		Trucked
First 1° Packaging i.e. PET bottles	08	Solid			250ml	Trucked

1. Identify All Potential Hazards

The team develops a list of potential biological, chemical, and physical hazards that may be introduced, increased, or controlled at each step in the production process. Each step in the flow diagram would be considered in turn to identify all the potential hazards.

1.1 Biological Hazards-Enteric pathogens such as the bacterium *E. coli*, various Salmonella species, and the protozoan parasite *Cryptosporidium parvum* may be present on kiwi or in milk and can contaminate the product to cause serious food borne illness outbreaks. (Tortorello 2011)

These microorganisms inhabit in the intestine of animals, produce can become contaminated when animals and their manure or feces share in an environment, either directly or indirectly through such means. And the kiwi fruit can be contaminated by irrigation water or during harvest or handling.

Viruses' contamination in food is most likely to be caused by an ill farm worker or food handler. Thus, contamination of by viruses is not likely to occur in a processing facility that controls, under GMP and GHP.

1.2 Chemical Hazards-Pesticides are used widely to control insect in fruits, vegetables, grains, and other foods, and may be present in small amounts as residues on these foods. (FDA 2004) And also for animals product (e.g. milk), it may be contaminated by feeding animals with pesticides contaminated feedstuff.

Residues from unapproved pesticides or residues in excess of pesticide tolerances in juice could result in a potential hazard. They may occur over an extended period of time at low levels capable of causing health effects from chronic exposure, or they may occur for only a brief period of time at high levels capable of causing acute health effects.

Patulin is a mycotoxin that is produced by fungi commonly found on fruit, so patulin contamination is likely to be produced and increased in the fruit during growing or bulk storage, and damage to fruit at handling stage can increase the risk of subsequent contamination as well (FDA 2004).

High levels of patulin can occur in kiwi juice made from fallen kiwi or damaged kiwi that contain mould, rot, or other damage, e.g., by insects or birds, or bruised. If fallen fruit, mouldy, rotten, bruised or damaged kiwi, or improperly stored kiwis are used to make juice, high levels of patulin may occur in the juice, and patulin present in kiwi fruit will carry through to the final product because patulin is not destroyed by thermal processing. Hence it is important to both minimise contamination, and reduce levels of contamination to the acceptable level.

1.3 Physical Hazards-There are no specific physical hazards, e.g. metal fragments, for which control measures are required under the HACCP regulation. Metal fatigue or worn/damaged blades in equipment used for grinding fruit can introduce metal fragments into juice. FDA has issued a Compliance Policy Guide (FDA 2005) describing when hard or sharp foreign objects in food, such as glass or metal fragments, could pose a health hazard.

During kiwi juice process, operations such as the grinding of fruit, or cutting operations, where metal fatigue or metal to metal contact can occur in the processing equipment, so metal fragments should be considered as a part of the potential hazard. And metal fragments may present in the final product when there are no controls in place.'

2. Evaluate All Potential Hazards

The team assesses all the likelihood of a potential hazard occurring if not properly controlled and determines the control measure for each potential hazard.

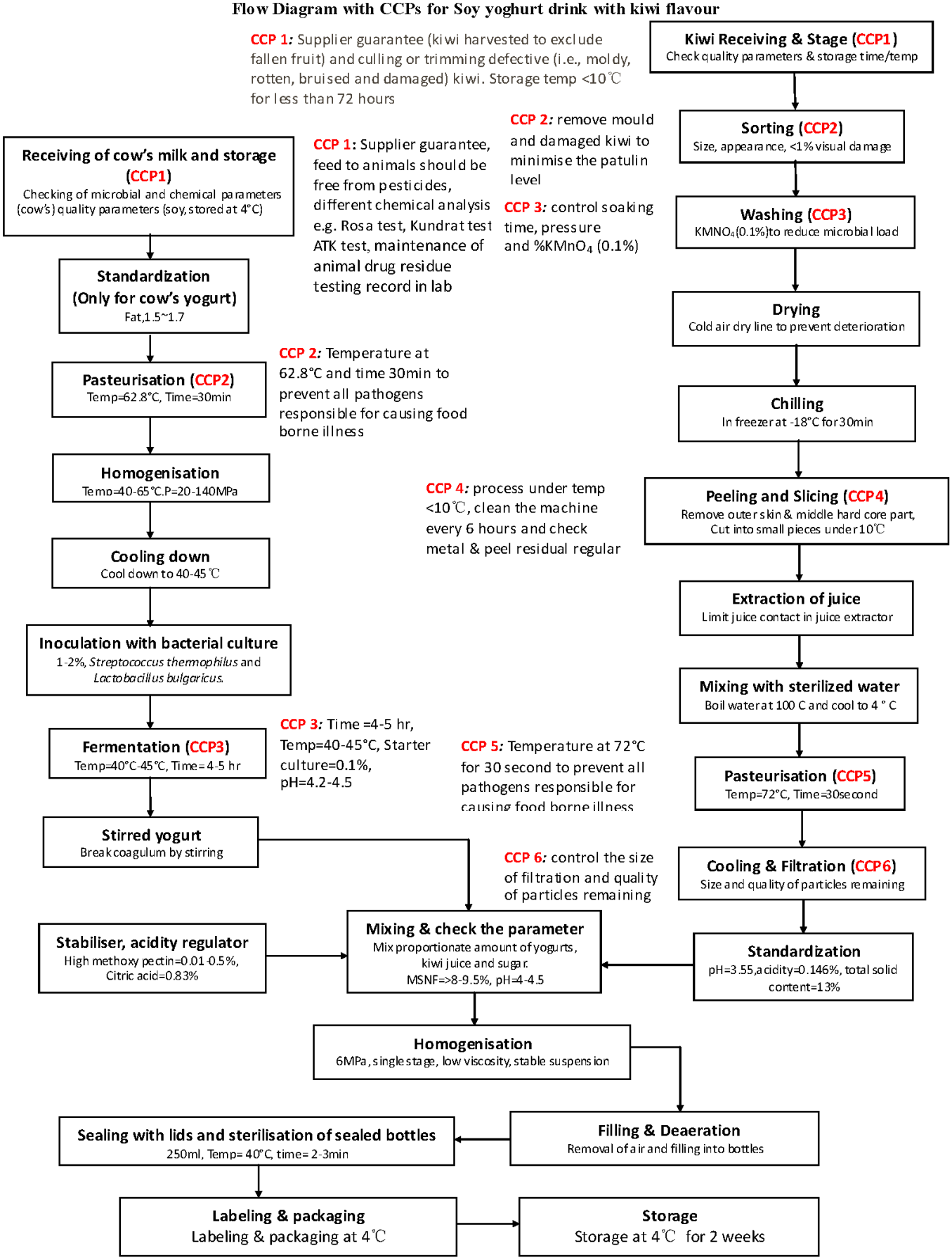
2.1Pathogens-Epidemiological evidence indicates that *E.coli*, *Cryptosporidium parvum*, *staphylococcus aureus*, and *Salmonella* can cause severe and life-threatening food borne illness (FDA 2004). Unpasteurized yoghurt drink has been linked to illness outbreaks from these pathogens. Because the milk and fruit will be process, there is a reasonable chance for the pathogen to be present in the final product if it is present in milk or on kiwi. So the quality control of raw product and microbiological test during the whole process is necessary, sorting and washing of the kiwi, pasteurisation of both milk and kiwi juice are also very important to minimise the risk of pathogen contamination.

2.2Patulin-Exposure over a period of time to high levels of patulin may pose a health hazard. Available data indicates that if dropped or damaged fruits are used to make juice, high levels of patulin may be reasonably expected to occur in the juice. Since the patulin contamination can not be reduce by thermal process, the select of raw material suppler and raw material test are very important to insure the quality of the product. Washing (in particularly pressure spraying) can remove patulin effectively. And filtration step can also be designed to minimise the patulin in juice to an acceptable level, when patulin bound to solid particles of kiwi flesh are removed by control the size of filtration.

2.3Pesticides-Acute or chronic exposure to unapproved pesticide residues can cause a variety of adverse health effects, some of which could be severe. Harmful pesticide residues in the fruit and animal products which may contaminated are not likely because in EU produce, the using of pesticide are limited and unapproved pesticide residues occur infrequently(EUR-Lex 2005). So control of growth, harvest and handling of the raw material are very important to avoid the pesticides, on the other hand, raw material superliner guarantee are also important to minimise the pesticides in product.

2.4Metal Fragments-If large enough, metal fragments in food product can cause injury when ingested. Without controls, there is no means in the process by which metal fragments from grinding equipment would be removed from the product. So check the equipment frequency and use metal detector in the product process is necessary to control the metal contaminations.

Flow Diagram with CCPs for Soy yoghurt drink with kiwi flavour



3. Development of a HACCP Plan

The aim of this step is to identify potential hazards, their significance and preventing measures which can be applied and finally through this procedure CCPs are defined. A worksheet determining the CCPs in yoghurt drink is given in Table 1.The development of the HACCP plan at each process step in the flow diagram is given below.

Table 1: CCP determination form

Form1: Critical Control Point Determination Form

Product name: Soy yogurt drink with kiwi flavour

Product description: Yogurt drink mixed with soy yogurt, cow's yogurt and kiwi juice

Process step	Is the hazard of sufficient likelihood of occurrence and severity to warrant its control? Yes: Proceed to next question. No: Not a CCP	Is this hazard fully controlled by a prerequisite program? Yes: Not a CCP. No: Proceed to the next question.	Q1. Do control measures exist for the identified hazard? Yes: Proceed to the next question. No: Either not a CCP or need to modify step, process, or product.	Q2. Is this process step specifically designed to eliminate or reduce the likely occurrence of this identified hazard to an acceptable level? Yes: CCP No: Proceed to the next question.	Q3. Could contamination with the identified hazard(s) occur in excess of acceptable level(s) or increase to unacceptable level(s)? Yes: Proceed to the next question. No: Not a CCP.	Q4. Will a subsequent step eliminate the identified hazard(s) or reduce its likely occurrence to an acceptable level? Yes: Not a CCP-Identify subsequent step. No: CCP	CCP number
Soy & Cow's Yoghurt line							
Receive & storage of soya/ cow's milk	YES	NO	YES	NO	YES	NO	1
Standardization (only for cow's milk)	NO	--	--	--	--	--	
Pasteurisation	YES	NO	YES	NO	YES	NO	2
Homogenisation	NO	--	--	--	--	--	
Cooling down	NO	--	--	--	--	--	
Inoculation with bacterial culture	YES	NO	YES	NO	YES	YES	
Fermentation	YES	NO	YES	NO	YES	NO	3
Stirred yogurt	NO	--	--	--	--	--	

Process step	Is the hazard of sufficient likelihood of occurrence and severity to warrant its control? Yes: Proceed to next question. No: Not a CCP	Is this hazard fully controlled by a prerequisite program? Yes: Not a CCP. No: Proceed to the next question.	Q1. Do control measures exist for the identified hazard? Yes: Proceed to the next question. No: Either not a CCP or need to modify step, process, or product.	Q2. Is this process step specifically designed to eliminate or reduce the likely occurrence of this identified hazard to an acceptable level? Yes: CCP No: Proceed to the next question.	Q3. Could contamination with the identified hazard(s) occur in excess of acceptable level(s) or increase to unacceptable level(s)? Yes: Proceed to the next question. No: Not a CCP.	Q4. Will a subsequent step eliminate the identified hazard(s) or reduce its likely occurrence to an acceptable level? Yes: Not a CCP-Identify subsequent step. No: CCP	CCP number
Kiwi juice line							
Receive & storage of kiwi	YES	NO	YES	NO	YES	NO	1
Sorting	YES	NO	YES	YES	--	--	2
Washing	YES	NO	YES	YES	--	--	3
Drying	YES	NO	YES	YES	--	--	
Chilling	YES	YES	--	--	--	--	
Peeling&slicing	YES	NO	YES	NO	YES	NO	4
Extraction	YES	NO	YES	NO	YES	YES	
Mixing with sterilized water	YES	NO	YES	NO	YES	YES	
Pasteurization	YES	NO	YES	YES	--	--	5
Filtering	YES	NO	YES	NO	YES	NO	6
Standardization	YES	YES	--	--	--	--	
Mixing all the ingredients							
Homogenisation	NO	--	--	--	--	--	
Filling & Deaeration	YES	NO	YES	NO	NO	--	
Sealing	YES	NO	YES	NO	NO	--	
Labeling & packaging	NO	--	--	--	--	--	
Storage	NO	--	--	--	--	--	

Table 2: HACCP plan for the management of the manufacture of low fat yoghurt drink with kiwi flavour

Ingredient/ process step	Hazards	Control measures	Control point	Critical limits	Monitoring procedures			Corrective action
					What & How	Frequency	Who	
Soy and cow's Yoghurt line Receiving cow's milk / soy milk	**Biological (B)**- Presence of pathogens responsible for illness e.g [23]*Salmonella sp,C.botulenum* **Chemical (C)**- Antibiotics, environmental contaminants, mold growth in animal feed contaminate milk with mycotoxins (aflatoxin M_1) ,pesticides ,insect icides **Physical (P)** - Unhygienic dairy, milk is drawn in unclean environment and is not protected which causes incorporation of any foreign material such	Microbiological analysis of milk .e.g[21] Standard plate count and coliform count, bacterial count, sediment, direct microscopic count, antibiotic residue[8] Verify that all tanks or trucks are cleaned, sanitized and temperature of the milk has been maintained before unloading, keep records for each tanker route Supplier guarantee,feed to animals should be free from pesticides,[23]Different chemical analysis e.g Rosa test, Kundrat test, ATK test,maintenance of animal drug residue testing record in lab [23]In line filter, inspect tanker before offloading, quality of gaskets	**CP** **CCP** **CCP**	Bactoscan results:- Total microbial count of [20]Soy milk=(<50000/g, No presence of staphylococcus aureus, Salmonella, e coli; Standard plate count =not more than 20,000cfu/g) Cow's milk=[22](Total bacteria=30,000/ml, no positive test on drug residue detection, somatic cell count= not to exceed 7,50,000/ml) pH =6.6-6.8(cow's milk/soy milk) Vendor provides accurate records of correct applications and tests indicating that the feed and medicines if given to the cows are according to the government law	Vendor meets supplier for hygiene in dairy and instructions for animal feed. Approval from vendor and quality assurance manager Control of specification and quality certificate from supplier No damage and abnormal conditions	Each lot	Purchasing manager Quality assurance manager Person at receiving point	Reject milk if not compliant to microbiological limits and standard set by the company, look for alternative source

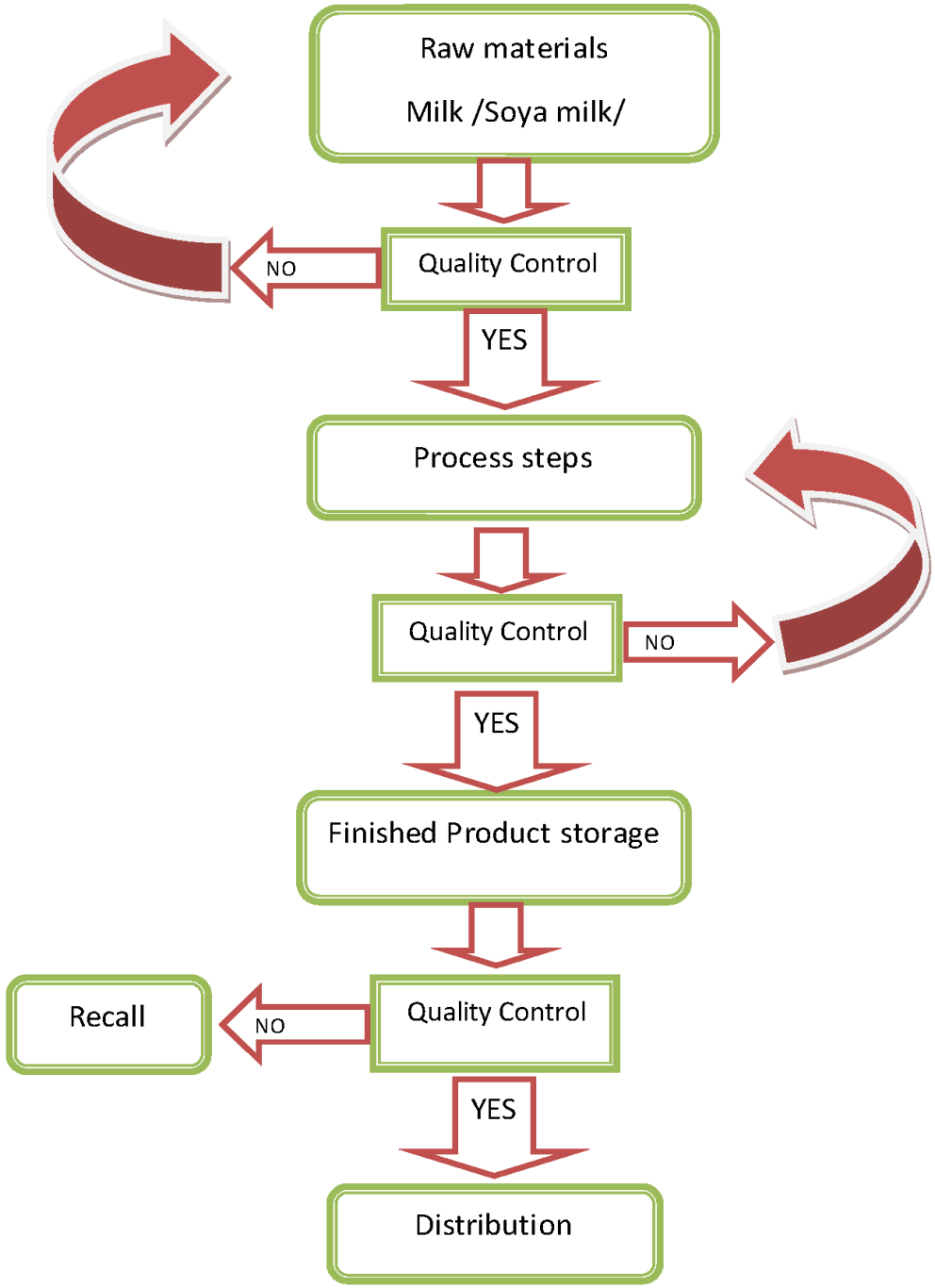
	as metal, glass, plastic, dirt, dust. Addition of ice to milk to cool down temp. of milk[24]							
Storage of cow's milk/soy milk	**B**- Growth of spoilage microbes and pathogens **C**- Improper hygiene in storage tanks,cleaning and sanitizing chemical residues.	Maintain temperature at 4°C Improper hygiene in storage tanks,[1]cleaning and sanitizing chemical residues	**CP** **GMP**	No damaged tanks Milk cooled to 4°C Use of chemicals and sanitizers within parameters and proper rinsing	Daily tank inspections [23]Maintenance of silos Quarterly checked by supplier of chemicals	Each after 6 hr	Production manager Shift incharge	Reject if not compliant to microbiological limits and presence of sanitizer and chemical residues
Standardization		Details in GMP manual 3.5	**GMP**					
Pasteurization	**B**- Presence of pathogenic micro organisms e.g. *Listeria innocua*	Temperature at 62.8°C and time 30min to prevent all pathogens responsible for causing food borne illness	**CCP**	Maintaining temperature at62.8°C - 64°C and time 25-30 min	Checking temperature and time	Each lot	Production manager Shift incharge	Re-pasteurize
Homogenization		Details in GMP manual 3.4	**GMP**					
Cooling & transfer of milk to holding tank	B- Chances of microbial growth. C- Residues of sanitizers after cleaning.	Cool down the temperature to fermentation temp. (40-45℃) Cleaning	**CP**	Cool milk to 40-45℃ [1]Tanks should be emptied, cleaned, sanitized each after 6 hr or less	Daily inspection of tanks	Each 6 hr	Quality manager	Re-pasteurize if only microbial contamination. Reject the lot in presence of chemical residues.
Inoculation with bacterial culture and fermentation	B- Excess growth of bacterial culture. C- Increase in acidity	Time of fermentation, temperature, amount of starter culture, pH affects the microbial content	**CCP**	Time=4-5 hr, Temp=40-45°C, Starter culture=0.1%, pH=4.2-4.5	Control of specifications	Each lot	Production manager	Reject batch
Kiwi juice line Raw kiwi receive	**Biological (B)**- Vegetative and protozoan enteric pathogens	Microbiological analysis.	**CCP**	Bactoscan results	Pasteurization Supplier guarantee (kiwi harvested to	Each lot	Purchasing manager Quality assurance	Reject if not compliant to microbiological limits Quarterly check by

	Chemical (C)- 1. Pesticides 2. Patulin	Supplier guarantee and culling or trimming defective	**CCP**	<10% damaged kiwi	exclude fallen fruit) and culling or trimming defective kiwi.		manager Person at receiving point	supplier of chemicals Reject batch or discard
Raw kiwi storage	**B**- Mould due to temperature abuse **C**-Patulin (Patulin levels may increase in storage.)	Control the storage temperature, make sure the storage room is clean Cull or trim defective kiwi Minimize the storage temperature	**CCP** **CCP**	Storage temperature < 10℃ storage time<72hours	Thermometer reading Storage time	Every day	Production manager	Adjust temperature Check monitoring system Inspect fruit
Sorting	**B**- Mould **C**- Patulin	Remove mould kiwi Patulin levels are reduced by culling defective kiwi	**CCP** **CCP**	<1% visibly mouldy kiwi	Visual observation & Quality check on samples	Each lot	Production manager operator	Discard or re-sort Adjust inspection procedure
Washing	**B**- Mould, contamination with pathogens such as salmonella from water **C**- Patulin	GMP/GHP for water quality Leach patulin from kiwi. Remove rotten parts of fruit containing patulin with pressure spraying	**CCP** **CCP**	Critical soaking time and pressure of spray system %$KMnO_4$ (0.1%)	Time of soaking step; regular check of water spray pressure	Each lot	Production manager Quality manager	Repeat the washing step
Drying	**P**- Water residual (may lead to damage of kiwi in chilling step)	Control the drying time Check water on peel	**CP**	Drying temperature<10℃, Enough drying time	Thermometer reading Storage time	Each lot	Production &Quality manager	Repeat the drying step
Chilling		Avoid damage of kiwi Keep freezer clean	**GMP**	Chilling temperature at 18℃ Chilling time for 30 minutes Clean every day	Thermometer reading Storage time	Each lot Check & Clean freezer every day	Production manager Quality manager	Check monitoring system Inspect fruit
Peeling& slicing	**B**- mould **C**- Patulin	Clean the peeling machine Keep the peeling & slicing temperature<10℃	**CCP**	Process temp.<10℃ Clean machine every 6 hours	Thermometer reading	Every 6 hours	Production manager Quality assurance	Discard if contaminated Conduct the peel and metal separator

	P- peel residual, Metal fragments	Check the machine and make sure there is no damage, check peel residual		Metal and peel residual are not present			manager	
Extraction	**P**- Metal fatigue, worn and damaged blades can cause contamination of slurry.	Cleaning Check machine and metal in product	**GMP**		Check metal machine reading	Each lot	Production manager Quality manager	Daily inspections
Mixing with treated water	**B**- Protozoan enteric pathogens	Boiled water before mix and cool to 4℃ Water hardness<10ppm C_aCO_3	**CP**	Boiled water at 100℃, and mix at 4℃		Each lot	Production manager Quality manager	
Pasteurization	**B**- Vegetative and protozoan enteric pathogens	Pasteurization at 72°C for 30 seconds to prevent all pathogens responsible for causing food borne illness	**CCP**	Maintaining temperature at72°C for 30 seconds	Automated readout	Each lot	Production manager Quality manager	Re-pasteurisation
Cooling & Filtration	**C**- Patulin	Control the size of filtration and quality of particles remaining[1] Cooling temp=4℃	**CCP**	Size and quality of particles remaining Cooling temp=4℃	Laboratory test Thermometer reading	Each lot	Production manager Quality manager	Un-block/replace filter Re-filter juice
Standardization		Details in GMP manual 3.5	**GMP**					
Mixing		Details in GMP manual 3.15	**GMP**					
Homogenisation		Details in GMP manual 3.4	**GMP**					
Filling & Deaeration	**C**- Oxidation	Details in GMP manual 3.16/3.17	**CP**	Pressure	Automated readout	Each lot	Quality manager	
Sealing	**B**- Growth of spoilage microbes and pathogens	Check the bottle make sure there is no damaged and unsealed bottle Seal at 4 ℃	**CP**	No damaged and unsealed bottle Temp= 4℃	Thermometer reading Visual check	Each lot	Quality manager	Discard the damaged bottle
Labeling & packaging		Details in GMP manual 3.18	**GMP**					
Storage	**B**- Growth of spoilage microbes and pathogens	Maintain the storage temperature at 4 ℃	**GMP**	No damaged bottle Storage temp= 4 ℃	Thermometer reading	Every day	Quality manager	

7. Plan for the quality control of raw materials and the final products

Chart for quality control



Quality control programmes propose to maintain a processing line in accordance with predetermined parameters for a given quality level. The basic goal of quality control is to insure that the products, process or service supported is under control and meet specific requirements. The main objective is to ensure that the provided product is of high-quality and it is safe for consumers. There are three main aspects for conveniently considering the product quality control: (i) raw material control, (ii) process control and (iii) finished product inspection (Hawthorn 1984).

Management of raw materials

For high quality of soy yoghurt drink with fruit flavor, the raw materials should be evaluated. The basic ingredients of soy yoghurt drink with kiwi flavor are: soya milk, cow's milk, kiwi fruit, sugar and water. The requirements will be listed individually for each ingredient.

Soya milk and milk

Soya milk has similar structure with milk, so that the requirements are the same. If the milk or soya milk is provided in bulk, then a typical set of figures might be checked as presented in **Table 4**. The quality of milk or soya milk should meet the requirements listed in **Table 4**. A good quality and nutritious milk or soya milk may provide a better environment for bacterial.

Table 4. Basic requirements for soya milk and milk

Attribute	Requirement
Temperature on arrival	< 10°C
Total colony count	≤100 000 $cfuml^{-1}$ (target) (<250 000 $cfuml^{-1}$ may well be acceptable in practice)
Inhibitory substances	≤0.007$IUml^{-1}$ (0.004$mgml^{-1}$)
Chemical composition	≥3.0 g fat 100 g^{-1} ≥3.0 g protein 100 g^{-1}
Somatic cell count	≤$4.0\times10^{5}ml^{-1}$
Freezing point depression	≤0.520°C
Titratable acidity	≤0.2% lactic acid

Source: (Tamime 1999)

Kiwifruits

The quality of kiwi fruits can be measured in described attributes, as can be seen in Table 5. A specification would be agreed and recorded with the supplier or the seller.

Table 5. industry requirements for kiwifruits

Attribute	Accept	Reject
Ripeness	Grow 150-220 days Between Medium-soft	Less than 150d or more than 220d
Size	Any	-
Shape	Any	-
Damage *- splitting* *- insect* *- mould*	 Less than 5% Less than 5% None	 More than 5% More than 5% Any evidence of mould
Soluble solid content	9-12%	Less than 9% or more than 12%

Source (Xiao 2004)

Sugar

Sugar should be packed in air tight water proof bags. The attributes of sugar are listed below in **Table 6**. They should be random measured after receiving.

Table 6 Industry requirements for sugar

Attributes	Accept	Reject
Colour and Shape	White and ground, no coagulum	Colour change to yellow, coagulum exists
pH	6.5 – 7.0 for pure sugar	Too high or too low of pH is NOT accept
Moisture (%)	0.2 – 0.6	Too high or too low is not accept

Source: Sugar Quality

Water

Water is used throughout the yogurt drink production chain. The quality of water can have significant impact on the quality and taste of food products. The detail of water quality requirements are showed below in **Table 7.**

Table 7 The Water Quality Definition for a hypothetical water supply situation

Attribute	Quality requirements for food industry
Hardness(ppm)-- $CaCO_3$	< 10
Colour (ppm)	< 30
COD (ppm)	< 50
Bacteria (CFU)	< 100

Source: (Grüttner et al., 2010)

Management of processing

Process control is related to critical points of HACCP plan in order to ensure the high quality of soy yoghurt drink with kiwi flavour. Therefore, it is necessary to establish control points on all these operations. Five points were chosen for the most important control points which are listed as follows:

1. **Raw material storage**

The temperature of storage for cow's milk and soya milk in tank should be controlled at 4°C. As for the kiwis, they should be kept in storage plant at 10°C to maintain their freshness. Additionally, good hygiene and clean should be controlled for the storage tanks.

2. **Pasteurisation**

Pasteurisation for cow's milk and soya milk should be maintain at 62.8°C - 64°C for 25 to 30 min in order to prevent all pathogens responsible for causing food borne illness. On-line measurements of the temperature and time should be controlled in every pasteurisation process. The record needs to be kept and collected by a trained quality control staff. Off-line test of alkaline phosphate test should be conducted every hour.

3. **Inoculation with bacterial culture and fermentation**

In inoculation with bacterial culture and fermentation, time, temperature and pH are important to control. Time of fermentation should be between 4 to 5 hours, temperature should control at 40-45°C, amount of starter culture should be 0.1% and pH value should be 4.2-4.5. Temperature and pH need to be test on-line every half hour to ensure that fermentation is under control.

4. **Sorting kiwi fruits**

Sorting is mainly for collecting and checking high quality kiwi fruits. Mouldy kiwi fruits need to be removed.

5. **Washing kiwifruits Mixing with sterilized water**

Flood water and mixing water should be controlled in this process. Water should contain less than 100 CFU of bacterial while should be free from Legionella. Hardness of water should less than 10ppm C_aCO_3.

6. **Filtration**

Particle size needs to be controlled. Same partide size of fluid need to be maintained. One trained quality control staff should keep checking the record from machine.

7. **Filling , Deaeration and Sealing**

Filling pressure should be checked every half an hour to maintain everything goes fluently. Air check aims to reduce air content in products so that keep a shelf-life quality. Empty bottles need to be checked throughout line. A trained quality control staff should keep standing near bottle filling line so that to easily detected any damaged bottles. All these process need to controlled under 4°C.

Finished product

For the final products, there should are a series of tests to make sure that they are safe. These tests include chemical, physical, microbiological and organoleptic analysis such as viscosity, flavour, body and texture, colour, PH and composition. Test can be conducted to check efficiency of packaging material and properties of final product.

The packaging materials should be tested by sterility testing to guarantee the safety and verify printing standards. The filler checks should be made by the seals, coding, record weights and fill temperature (Ramesh, 2006). Once the data we get is beyond the required limits, we should go back to the proceeding progress to find the critical point.

Yogurt drink after packaging will be tested every 24 hour for the shelf life. The pH, flavour, texture, viscosity and E.coli form count should be tested to check whether the risk is under control.

8. Plan of action for unit V

We have developed our product for market in unit IV. We designed HACCP, GMP and GHP which would help us to give high quality product. We worked on shelf life, packaging and legislation. Furthermore, we will be working on following tasks in next unit:-

- Finish unfinished task of unit IV i.e. shelf life experiment and conclude results of it.
- Propose the final marketing plan with marketing strategy which includes marketing objective, product and market background, marketing analyses etc.
- Propose a product launch strategy which included targeting strategies, timing strategies etc.
- Conduct product test launch with presentation of the product including product label and product launch poster

Task	Milestones	Date of completion
Task 1	Unfinished task of unit IV	(14/8/11)
Task 2	Marketing plan	17/8/11
Task 3	Proposal of product launch strategy	22/8/11
Task 4	Conduct product test launch	26/8/11

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HACCP-

APPENDIX

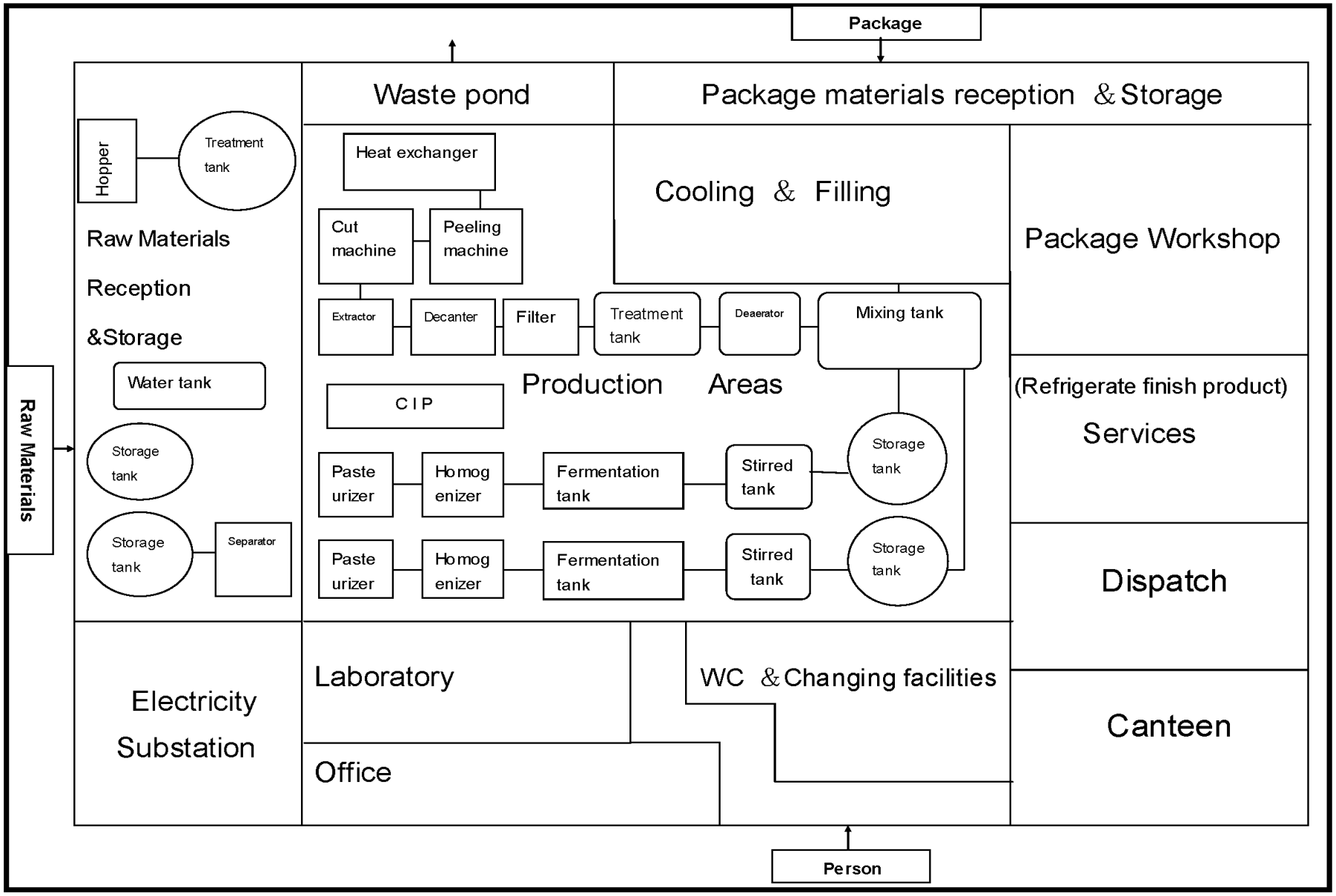
Package
Waste pond
Package materials reception & Storage
Hopper
Treatment tank
Heat exchanger
Cooling & Filling
Raw Materials Reception &Storage
Cut machine
Peeling machine
Package Workshop
Extractor
Decanter
Filter
Treatment tank
Deaerator
Mixing tank
Water tank
Production Areas
(Refrigerate finish product) Services
C I P
Raw Materials
Storage tank
Paste urizer
Homog enizer
Fermentation tank
Stirred tank
Storage tank
Storage tank
Separator
Dispatch
Electricity Substation
Laboratory
WC & Changing facilities
Canteen
Office
Person

Table. Results of Tukey's honestly significant difference test

Attribute		diff	lwr	upr	P adj
sweetness	B-A	-0.08928571	-1.0722410	0.89366962	0.9917193
	C-A	-1.78571429	-2.7686696	-0.80275896	0.0000003
	D-A	-1.12500000	-2.1079553	-0.14204467	0.0022097
	C-B	-1.69642857	-2.6793839	-0.71347324	0.0000010
	D-B	-1.03571429	-2.0186696	-0.05275896	0.0058285
	D-C	0.66071429	-0.3222410	1.64366962	0.1494558
milk flavour	B-A	0.05357143	-0.8182248	0.9253677	0.9973923
	C-A	-2.14285714	-3.0146534	-1.2710609	0.0000000
	D-A	-1.64285714	-2.5146534	-0.7710609	0.0000001
	C-B	-2.19642857	-3.0682248	-1.3246323	0.0000000
	D-B	-1.69642857	-2.5682248	-0.8246323	0.0000000
	D-C	0.50000000	-0.3717962	1.3717962	0.2708005
thickness	B-A	-0.21428571	-1.235395	0.8068239	0.9106447
	C-A	-2.62500000	-3.646110	-1.6038904	0.0000000
	D-A	-2.60714286	-3.628252	-1.5860333	0.0000000
	C-B	-2.41071429	-3.431824	-1.3896047	0.0000000
	D-B	-2.39285714	-3.413967	-1.3717476	0.0000000
	D-C	0.01785714	-1.003252	1.0389667	0.9999391
overall acceptability	B-A	-0.03571429	-1.0162939	0.9448653	0.9994519
	C-A	-2.44642857	-3.4270081	-1.4658490	0.0000000
	D-A	-1.78571429	-2.7662939	-0.8051347	0.0000002
	C-B	-2.41071429	-3.3912939	-1.4301347	0.0000000
	D-B	-1.75000000	-2.7305796	-0.7694204	0.0000004
	D-C	0.66071429	-0.3198653	1.6412939	0.1478626

Table. Tukey HSD by ranking test

Attribute		Ranktotals
fruit flavour	A-B	4.0000
	A-C	140.0000
	A-D	92.0000
	B-C	136.0000
	B-D	88.0000
	C-D	48.0000
critical distance for HSDRanks		35.1588